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Editorial

In the past spices played an important role in the history of mankind leading to the discovery of new lands, new sea routes and colonisation by the European nations. They have again attained an international importance today as a result of the last global war. India finds itself in an enviable position as the sole supplier of many of these spices. It is but natural that she should strive to evolve means and methods to maintain her dominant position regarding these commodities. Her serious rivals are the Indonesian and Malayan countries and possibly tropical Africa and tropical S. America. The Spices Enquiry Committee appointed by the I. C. A. R. to go into the several problems of the improvement and expansion of these dollar-earning crops and also of cashewnut have recommended the creation of the separate fund of 1·25 crores to be expended on the six important spices and cashewnut. The Committee after an extensive enquiry tour and first hand study has submitted a comprehensive report. Three regional advisory committees are recommended to be located at (1) Travancore-Cochin, (2) Malabar and South Kanara and (3) Mysore including Coorg and North Kanara. With regard to pepper the Committee has rightly warned the growers and traders that unless rapid improvement such as replacement of unproductive vines with more profitable ones, adoption of intensive cultivation methods and lowering the cost of production, the leading position of this country may be lost. To help promote this end the Committee has recommended the raising of a fund of one crore of rupees from the export duty levied on this spice. Cardamom on the other hand has not the possibility of further expansion of export trade. India is the main supplier and the produce exceeds the requirement. Hence the Committee recommends investigation into possibilities of utilising the crop here itself and particularly improvement of market intelligence in this crop. Ginger though produced in large quantities suffers from competition from Trinidad etc., and has to be improved

Contributions of the Mechanical Fractions of the Soil and its Organic Matter towards Potash fixation*

by

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Introduction: Perhaps the first use of the world "fixation" was in reference to nitrogen, following the famous discovery of Hellriegel and Willfarth. Fixation was later on applied to immobilization of phosphorus by soil. Now the importance of potash-fixation on the lines of nitrogen and phosphate-fixation has been fully appreciated and investigated. Accordingly the phenomenon of potash-fixation was studied on our soils.

Historical: Studies relating to potash-fixation by soils have been made by Raney and Hoover (1947), Walsh and Cullinan (1945), Attoe (1947), Ayres (1941) Hauser (1941), Martin (1946), Volk (1938), Jacob (1940), Page (1944), and Joffe and Levine (1947). But little work has been done to determine those fractions of the soil that are more active in potash-fixation.

Pathak, Shrikhande and Mukerji (1950) studied the potash-fixing capacity of the different mechanical fractions of the soil and its organic matter. They observed that potash-fixation was exhibited by all the three mechanical fractions of the soil and also that organic matter depressed potash-fixation. Gourley and Wander (1919), Sturgis and Moore (1939), Walker and Sturgis (1940) and Worsham and Sturgis (1942) have also pointed out from field experiments that organic matter exerts a depressive effect on potash-fixation. Worsham and Sturgis (1942) observed that potash-fixation in soil varied from 0·0 to 209 ppm. in Portland silt loam and Sharkey clay loam. Comparison of potash fixed in A and B horizons of all the soils showed an increase of fixation in the B horizon. The addition of organic matter decreased the fixation of potash by 6 to 41 ppm. Jaffe and Kolodny (1937) have recorded that the quantity of potash fixed varied from 0·31 to 2·4 mg. and that organic matter is not capable of fixing potash. Martin (1946), working with arid soils, could not attribute fixation to the presence of organic matter and Joffe and Levine (1947) also found that the addition of organic

* A part of thesis for the degree of Doctor of Philosophy in the University of Agra, U. P.

matter depressed fixation. They also observed that when potassium acetate was added 17·7 mg. potash was fixed as compared to 13·7 mg. with potassium chloride. Similar differences in the amount of potash fixed with different potash-salts have been recorded by DeTurk, Wood and Bray (1943). They studied potash fixation in corn belt soils and observed that the addition of potash as phosphate resulted in greater fixation than addition of equivalent amounts as chloride. The amount of potash fixed as phosphate was 1½ to 2 times greater than the amount of potash fixed as chloride. Sturgis and Moore (1939) studied potash-fixation in Louisiana soils and reported little fixation of potash when applied as potassium chloride. Raney and Hoover's (1947) results on potash-fixation with potassium chloride and dipotassium phosphate also indicate differences in potash-fixation with different potash salts.

Some of the above observations, particularly the effect of organic matter on the potash fixing capacity of the different mechanical fractions of the soil were investigated here with potassium chloride and dipotassium phosphate.

Plan of Investigations: Composite samples of soil were taken from different locations in an acre of the manured and unmanured plots from the Kanpur Agricultural College Students' Farm. Six randomised places were located for profile digging. Samples were collected separately from the manured and unmanured plots from 0–6", 6"–1' and 1'–2' from each of the six profiles. After thorough mixing the various mechanical fractions of the soils were isolated and kept for analysis.

The soils and their mechanical fractions were shaken for 6 hours in an end-on shaker with potash-solution containing 5·0 mg. K_2O per ml. of solution. Ratio of soil to solution was adjusted to 1 : 10. After shaking they were filtered and 5 ml. of the clear filtrates were then used for the estimation of potash.

Methods of analysis: 1. *Mechanical analyses:* Pretreatment and dispersion were affected according to the recommendations of the International Society of Soil Science (Wright 1939) followed by pipette sampling for silt and clay fractions. 2. *Potash* was estimated volumetrically by the cobaltinitrite method (Wright 1939).

Experimental Results: Mechanical composition of the soil is recorded in table 1 and potash fixing capacity in table 2.

TABLE 1

Mechanical composition of the soil

	Manured			Unmanured		
	0 —6"	6" —1'	1' —2'	0 — 6"	6" —1"	1' —2'
Clay	13·35	21·45	29·33	13·84	20·17	26·63
Silt	20·10	21·90	21·22	21·54	22·50	22·88
Sand	66·00	55·60	47 90	63 84	56·15	48·75

TABLE 2

Potash-fixing capacity of the various fractions as K_20 in mgm.

	Manured				Unmanured			
	0 —6"	6" —1'	1 —2'	Mean	0 —6"	6" —1'	1 —2'	Mean
Clay	4·63	7·56	8·79	6·99	5·29	7·29	8·92	7·16
Silt	8·77	4·73	7·17	6·89	10·70	3·96	5·04	6·56
Sand	0·26	0·22	0·30	6·26	0·37	0·31	0 31	0·33

The data in table 2 indicate that potash fixing capacity is not restricted to the clay fraction alone; on the contrary, the surface silt fraction of plot has shown greater potash fixing capacity than the surface clay fraction. Potash fixing capacity of clay for the manured plot varies from 4·6 to 8·8 mg %. Silt fraction has a large potash fixing capacity and is on the average 6·89 mg % for the silt of the manured soil and 6·56 mg % for unmanured soil. Potash fixing capacity of sand, however, was found to be very small in both manured and unmanured soils. When these different fractions are compared amongst themselves for potash fixation from both the soils it will be noticed that the clay, silt and sand of the unmanured soil has greater potash fixing capacity.

From the mechanical analysis in table 1 and the corresponding potash fixing capacity in table 2 the contribution from the various fractions, deviod of organic matter, has been calculated. These calculated values along with the potash fixing capacity of the original and H_20_2 treated soil are shown in table 3.

TABLE 3

Calculated potash fixing capacity of the soil and the contribution of different fractions free of organic matter in mg. %

	0 —6"	6" —1'	1' —2'	0 —6"	6" —1'	1' —2'
A. Untreated soil	1·271	1·662	3·428	2·306	1·637	2·848
B. Soil after oxidation of O. M. with H_20_2	2 091	2 240	3·820	2·963	2·057	3·078
C. Clay	0·618	1·622	2·577	0·732	1·467	2·376
Silt	1·762	1·035	1·522	2·305	0·891	1·154
Sand	0·170	0·137	0·142	0·238	0·176	0·151
Total from primary particles	2·550	2·794	4·241	3·275	2·534	3·681
D. K-fixing capacity of soil if clay is the only active fraction	0·618	1.622	2·577	0·732	1·467	2·376

It is interesting to note from the data in table 3 that the potash-fixing capacity as found by actual analysis (B) is lower than the sum of the calculated potash-fixing capacity of the different fractions (C). This difference between the two values though small, is still significant; this may be due to the interaction between the different minerals present in the sand, silt and clay lattice.

Potash-fixing capacity of the surface layer of the untreated and H_2O_2 treated soil of the unmanured plot is greater than that of the manured one. This may be due to the inhibitive action of organic matter on potash-fixation as indicated before. By comparing the figures in table 3 for the untreated soil (A) and H_2O_2 treated soil (B), the depression due to organic matter on potash-fixation is more clearly brought out. All the values for (B) are greater than the corresponding values for (A).

The decrease in potash-fixing capacity due to organic matter is expressed as the difference between the potash-fixed before and after H_2O_2 treatment of the soil. For the manured plot the value lies between —0·39 to —0·82 mg % and for the unmanured plot between —0·23 to —0·65 mg %. This agrees with the observations of Worsham and Sturgis (1942) who observed an adverse effect of organic matter on potash fixation by 6 to 4·1 p.p.m. i. e. 0·5 to 4·1 mg %.

When allowance is made for the potash-fixing capacity of sand, silt and clay in the potash-fixing capacity of the untreated soil, a value is obtained which is expressed in table 4 as the potash-fixing capacity calculated from primary particles (Y). Neglecting the potash-fixing capacities of silt and sand and assuming that fixation occurs only in clay the value obtained is expressed as potash-fixing capacity of the organic matter (Z). If the entire potash-fixing capacity were due to clay alone, the potash-fixing capacity of organic matter should have been positive, but apparently this is not the case as is seen from tables 4 and 5.

TABLE 4

Decrease in potash-fixing capacity due to organic matter in mgm per 100 gm soil

		Manured			Unmanured		
		0—6″	6″—1′	1′—2′	0—6″	6″—1′	1′—2
Org. carbon in soil		0·448	0·224	0·194	0·251	0·213	0·182
* Org. matter in soil		0·771	0·385	0·334	0·432	0·366	0·313
X	A—B	—0·820	—0·578	—0 394	—0·657	—0·420	—0·230
Y	A—C	—1·279	—1·132	—0·813	—0·969	—0·879	—0·833
Z	A—C	0·653	0·040	0·851	1·574	0·170	0·472

*** (organic carbon X 1·72 = Organic matter)**

The values denoted by X and Y in table 4 are greater for the manured plot than for the unmanured. This indicates some relationship between the organic matter content and depression in the potash-fixing capacity. When items X, Y and Z in table 4 are expressed on 100 gm. organic matter as in table 5, a clearer picture of the decrease in the potash-fixing capacity due to organic carbon is obtained.

TABLE 5

Potash-fixing capacity in mgm per 100 gm of organic matter

	Manured			Unmanured		
	0—6″	6″—1′	1′—2′	0—6″	6″—1′	1′—2′
Soil after H_2O_2 treatment	—106	—150	—111	—152	—115	—74
If clay is the only active fraction	85	10	255	364	46	151
From primary particles	—166	—295	—243	—224	—246	—266

The values recorded for H_2O_2 treated soil and those derived from the sum of the primary particles are negative ranging between —74 to —150 mg%. These values do not conform to the figures for potash-fixing capacity of organic matter after removal of the organic matter by H_2O_2 oxidation and after assuming clay to be the sole active agent. It is only after allowing for the contribution for potash-fixation by sand, silt and clay also, that we obtain figures (shown as from primary particles in table 5) which appear more correct.

When the potash-fixing capacity of the untreated soil was studied with the same concentration of potash as di-potassium phosphate as in the previous experiment, it gave a different result. Table 6 gives the result of potash-fixation by di-potassium phosphate. Similar figures for potassium chloride treatment are included for comparison.

TABLE 6

Effect of anion on potash-fixing capacity of soil in mgm%

	Manured			Unmanured		
	0—6″	6″—1′	1′—2″	0—6″	6″—1′	1′—2′
KCl	1·271	1·962	3·428	2·309	1·637	2·845
K_2HPO_4	1·834	2·405	4·565	3·654	2 397	4·053

The data in table 6 indicate that a larger part of the potash was fixed when added as phosphate than when it was added as chloride as observed by De Turk, Wook and Bray (1943), Sturgis and Moore (1939) and Raney and Hoover (1947) who obtained 1½ to 2

times greater fixation of potash when applied as dipotassium phosphate than when applied as potassium chloride. This has been attributed to the linkage of phosphate-ion with some of potash-ion to the colloidal particles, besides its absorption by the replacement of OH ion of the clay colloid. Hence the association of potash-ion in di-potassium phosphate resulted in increasing the amount of potash fixed by nearly 1½ times as compared to chloride.

Discussion: The earlier concepts of soil activity were for the most part, based upon analyses of, or experiments with, the whole soil. It was only clay, besides organic matter, which has long been considered to take part in the fertility of soil. The coarser silt and sand fractions were considered until recently as almost inert. But the potash-fixing capacity of the coarser particles of the soil, particularly silt, and mechanical analysis which shows on an average 20–60% of silt and sand in the soil respectively, suggest that silt and fine sand fractions can now no longer be ignored in assessing the total activity of soils.

From the practical and economic point of view, the question naturally arises as to what is the value of potash that has been fixed in the soil. Fixation interferes with the immediate utilization of potash fertilizers by crops. Not all of the potash applied to the soil is ordinarily taken up by the first crop, and fixation, therefore, decreases the loss of unused potash in drainage water. This protection against leaching following large potash-application, is a certainty. Application of heavy doses of potash results in the building up of the colloid held potash reserve which is a reservior from which supplies of available potash for crop production are derived year by year. According to Seatz and Winters (1943) the exchangeable potash remains in equilibrium with potassic soil minerals and that when the degree of potash saturation of the colloids is altered by manuring and cropping, it tends to be fixed and released respectively.

Summary: Potash-fixing capacity of the soil, original and H_2O_2 treated, and its mechanical fractions was tested. It was found out that all the three mechanical fractions showed potash fixation. The silt fraction showed a higher potash fixing capacity which was as high as that of clay. On the surface greater activity was shown by the unmanured plot than the manured one. Potash fixing capacity of H_2O_2 treated soil was higher than the untreated soil. It was also observed that the soil showed greater potash fixation when it was applied as potassium chloride.

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Seed Treatment against Black Arm Disease of Cotton

by

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Introduction: Black arm or angular leaf spot or bacterial blight of cotton caused by *Xanthomonas malvacearum* (Smith) Dowson, has been prevalent in the Madras State for over thirty years (Ramakrishnan 1950). Primary infection is mainly through the seeds. Rain combined with heavy winds (rainstorms) helps in the spread of the disease (Andrews 1936, Brown 1941). Control of primary infection of black arm by seed treatment has been attempted in several countries with varying degrees of success. Seed disinfection with formalin (1 : 100) has been found to be very effective in theU.S.S.R. (Verderevski 1937). Ceresan materially increased the seedling emergence and yield of cotton in various localities in Texas, at the same time reducing the incidence of angular leaf spot (Smith et al 1936). Massey (1937) has found that the use of mercurial dusts like Abavit B, ethyl mercury phosphate, ethyl mercury iodide, phenyl mercury acetate and several others gave satisfactory control of black arm in Africa. Seed treatment with mercuric iodide had resulted in the control of black arm in the Sudan (Clouston and Andrews 1938). Macdonald et al (1947) have stated that delinting with sulphuric acid and the removal of floaters have resulted not only in the reduction of primary infection of black arm but also improved the germination and vigour of the seedlings. Ramakrishnan (1950) used formalin as steep and dust, Ceresan and Agrosan GN as seed dressings and observed that all these gave protection from primary infection. Tarr (1953 a, b, c) after the use of several seed dressing agents found that mercuric iodide gave better protection as a steep than as a dry dressing. Tarr has further observed that slurry methods were most effective when applied to acid delinted seeds and that soluble organomercury compounds were preferable for slurry methods. Acid delinted seeds were much more susceptible to mercury injury than fuzzy ones. Cuprous oxide was also found to be a promising seed dressing for the control of black arm. (Tarr 1953 a).

Several seed dressings are being put on the market from time to time and in order to test their relative efficacy in comparison with organo-mercurials like Agrosan, Ceresan etc., a series of experiments were conducted both in the field and under greenhouse conditions. A brief outline of the results obtained in these experimentsis presented in this paper.

Materials and Methods: Seeds of MCU 1. cotton, were artificially inoculated with the pathogen by soaking the seeds in a suspension of bacteria for one hour and drying in the shade. They were then treated with various seed dressings for fifteen minutes at 1 : 150 by weight. Care was taken to ensure a thorough mixing of the fungicide with the seed so as to obtain a uniform coating of the substance on the surface of the seed. Delinting was done by using concentrated sulphuric acid at the

rate of 1 lb. of acid for 12 lb. of seed. The requisite amount of sulphuric acid was added little by little to the seeds kept in a mud or procelain container constantly stirring the seeds for about 15 minutes. These seeds were washed free of sulphuric acid in three changes of cold water and dried in the sun. The floating seeds were removed while washing and tested separately. In the case of the pot experiments the number of replications varied from 3 to 5 and in each replication (seedling pan) 30 to 50 seeds were sown. Records of germination and percentage of primary infection were maintained. In addition, the vigour of the seedlings was assessed by recording their linear growth. The results were subjected to statistical analysis. Experiments were conducted under both greenhouse and field conditions.

Observation: In one series Agrosan GN, Fernasan, Y.F. 2776 and Perenox were used. The percentage of germination and primary infection in this experiment are given below:

TABLE I

Percentage of germination and primary infection

Treatment	Percentage of germination	Percentage of primary infection
Agrosan GN	82	12·2
Fernasan	69	24·6
Y. F. 2776	70	55·7
Perenox	73	61·6
Control	75	68·6

From the above it is evident that Agrosan GN and Fernasan have effectively reduced primary infection. Further, Agrosan GN has given a higher percentage of germination over control. The other fungicides were found to be more or less on a par with the control. It has been reported from Africa (Annual Rept. of the Emp. Cott. Gr. Corpn. 1952) that copper compounds not only reduced the primary infection but also increased vigour, yield etc. But from the above experiment it is clear that the copper fungicide Perenox does not afford sufficient protection against primary infection and is only on a par with the control under greenhouse conditions.

In order to confirm the findings with regard to germination and vigour, other experiments were conducted in pots using Agrosan GN and Perenox. The seeds after treatment were sown in pots

TABLE II

Germination Percentage in the Various Treatments on the 8th Day After Sowing

(Lay out—Split-plot Design)

Dates of Sowing	25th May 1953				10th June 1953				30th July 1953			
Main treatments / Sub treatments	Agro-san GN	Pere-nox	Con-trol	Mean	Agro-san GN	Pere-nox	Con-trol	Mean	Agro-san GN	Pere-nox	Con-trol	Mean
	(a)	(b)	(c)		(a)	(b)	(c)		(a)	(b)	(c)	
A. Acid-delinted seeds—SINKERS ..	82·50	76·50	90·00	83·34	90·00	92·66	95·34	89·34	90·63	96·30	96·30	94·38
B. Acid-delinted seeds—FLOATERS ..	51·00	44·50	41·50	45·66	64·00	47·34	49·34	43·56	62·50	66·25	71·25	66·68
C. Acid delinted seeds without removing floaters ..	69·50	71·50	66·50	69·16	72·66	56·00	61·34	63·34	80·00	85·63	81·25	82·30
D. Fuzzy seeds (Control)..	67·00	74·50	65·50	72·34	74·66	61·34	66·00	67·34	89·58	88·75	85·00	87·70
E. Fuzzy seeds treated with cowdung ..	—	Not included		—	—	Not included		—	82·50	71·25	76·25	76·65
F. Fuzzy seeds treated with red earth ..	—	Not included		—	—	Not included		—	80·63	79·38	73·13	77·73
Mean ..	70·00	66·76	66·12	—	75·33	61·84	68·00	—	81·78	81·25	80·52	—

	25th May 1953	10th June 1953	30th July 1953
Main treatments—Conclusions	Significant—C. D. = 6·60 A, D, C, B	Signicant—C. D. = 14·0 A, D, C, B	Significant—C. D. = 10·88 A, D, C, F, E, B
Sub treatments—Conclusion	Not significant	Significant C. D. = 6·80 a c b	Not significant

TABLE III

Mean Length of Seedlings in Centimeters on the 8th Day After Sowing
(Lay out—Split plot design)

Date of sowing	25th May 1953				10th June 1953				30th July 1953			
Main treatments / Sub treatments	Agro-san GN	Pere-nox	Con-trol	Mean	Agro-san GN	Pere-nox	Con-trol	Mean	Agro-san GN	Pere-nox	Con-trol	Mean
	(a)	(b)	(c)		(a)	(b)	(c)		(a)	(b)	(c)	
A. Acid-delinted seeds SINKERS ..	7·95	6·45	7·37	7·26	6·43	7·07	8·20	7·23	6·65	6·28	6·08	6·34
B. Acid-delinted seeds FLOATERS ..	6·80	6·14	5·47	6·14	7·47	6·23	5·70	6·47	5·50	4·80	5·08	5·13
C. Acid-delinted seeds without removal of floaters ..	7·41	6·05	6·20	6·55	6·33	5·13	6·17	5·88	5·73	5·23	5·75	5·57
D. Fuzzy seeds (Control)..	7·95	7·04	6·14	7·04	7·73	5·87	6·13	6·58	6·75	5·78	5·73	6·08
E. Fuzzy seeds treated with cowdung ..	—	Not included		—	—	Not included		—	6·55	5·50	5·25	5·77
F. Fuzzy seeds treated with red earth ..	—	Not included		—	—	Not included		—	5·85	5·55	5·75	5·72
Mean ..	7·53	6·42	6·29	—	6·99	6·08	6·55	—	6·78	5·52	5·60	—

	25th May 1953	10th June 1953	30th July 1953
Main treatments—Conclusions	Significant C.D. = 0·62 A, D, C, B	Significant—C.D. = 0·77 A, D, B, C	Significant C.D. = 0·53 A, D, E, F, C, B
Sub treatments—Conclusions	Significant, C.D. = 0·66 a, b, c	Significant—C.D. = 0·58 a, c, b	Significant C.D. = 0·34 a, c. b

containing washed sand. The seedlings were removed on the eighth day after sowing, their number counted and length measured. Here also, acid delinted and fuzzy seeds were utilised. The data on germination percentage and length of seedlings are given in tables II and III respectively.

It is clear from these tables that acid delinted sinkers always gave the maximum percentage of germination. Among the seed dressings Agrosan GN treated seeds gave the highest germination percentage and in one experiment this treatment was significantly superior to Perenox and control while Perenox treated seeds sometimes even produced lesser number of seedlings than the control. As regards the length of seedlings again, acid delinted sinkers produced the tallest seedlings. These findings are in keeping with the observation of Macdonald et al (1947). Among the seed dressings, Agrosan GN again gave significantly taller seedlings in two experiments, thereby indicating that Agrosan GN not only gave protection from primary infection but also induced the germination and vigour of the seedlings.

It is the general practice with ryots to treat cotton seeds with cowdung or red earth and dry them prior to sowing to facilitate easy separation of the seeds while sowing. In order to test the effect of these treatments, an experiment was conducted with graded doses of cowdung and red earth made into a paste with the minimum quantity of water required for thorough mixing with the cotton seed and sun-dried before sowing. The percentages of germination are given in table IV.

TABLE IV

Treatments				Germination percentage
Cowdung:	Cotton seed	1 : 3	by weight	66·4
do.	do.	1 : 6	do.	75·2
do.	do.	1 : 12	do.	80·4
do.	do.	1 : 24	do.	91·6
Red earth:	Cotton seed	1 : 3	do.	67·6
do.	do.	1 : 6	do.	69·2
do.	do.	1 : 12	do.	60·0
do.	do.	1 : 24	do.	83·2
Cotton seed treated with mere water				95 2
Control (Untreated) MCU 1 seed				94·8
		CD = 16·79		

It is seen from the above data that cow dung at strengths 1:12 and below and red earth at 1:24 did not affect the germination

capacity, while higher proportions impaired the germination to a marked extent.

In another experiment combinations of Agrosan GN with red earth and cow dung were used for treating the seed. The results are given in table V. Only fuzzy seeds were used in this experiment.

TABLE V
Percentage of germination and primary infection

Treatments			Germination	Primary infection
1.	Agrosan GN	1 : 150	87	3·4
2.	Agrosan GN	1 : 300	86	1·2
3.	Agrosan GN	+ red earth	83	6·0
4.	Agrosan GN	+ cowdung	74	6·8
5.	Red earth	+ Agrosan GN	85	9·4
6.	Cowdung	+ Agrosan GN	75	4·0
7.	Cowdung alone		83	10·8
8.	Red earth alone		87	11·5
9.	Fuzzy control		82	9·8

In treatments 3 and 4 the seeds were first treated with Agrosan GN and then with cowdung or red earth. In treatments 5 and 6 the seeds were treated first with cowdung or red earth and then with Agrosan GN. It is seen from the above that treatment with cowdung and red earth alone have not reduced primary infection while Agrosan GN has reduced the infection.

Field experiments were also conducted in 1952-53 season using Agrosan GN. Fernasan, Tritisan and Y. F. 2776 as seed dressings. Artificially infected MCU 1 fuzzy seeds were used for the experiment. The percentage of primary infection in the various treatments were recorded and are tabulated below :

TABLE VI
Percentage of primary infections in the various treatments

Treatment	% Primary infection
1. Agrosan GN	15·25
2. Tritisan	38·75
3. Y. F. 2776	18·13
4. Fernasan	5·13
5. Control	36·63
CD = 14·84	

The results were found to be statistically significant. Fernasan, Agrosan GN, and Y. F. 2776 were superior to control in reducing primary infection.

Conclusions: From the results of the foregoing experiments it is clear that indiscriminately heavy doses of cowdung and red earth have an adverse effect on the germination capacity of the cotton seeds and as such have to be avoided. Red earth at the strength of 1 : 24 and cow dung at 1 : 12 and below did not have an adverse effect on germination. The advantages of using acid-delinted sinkers

instead of cowdung or red earth treated seeds are:— (i) the former ensures more uniform, quicker and higher germination with better vigour of seedlings, besides facilitating easy separation of the seeds, and (ii) the cost of treatment with sulphuric acid works out only to Re. 1/- per acre and this is a negligible sum when compared to the benefits accruing from the treatment. In places where acid-delinting is found difficult, seed treatment with Agrosan GN will be of much use, as the latter also increases the germination capacity of the seed as well as the vigour of seedlings besides reducing seed-borne infection of black arm.

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Recent Developments in the Chemical Method of Pest Control

by

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Introduction: It is a well-known fact that on an average about ten percent of the produce is lost by the cultivators every year due to depredations of crop pests. Intensive research has been in progress in the Madras State for the past four decades on insecticidal methods of pest control. Based on the results obtained so far, an attempt is made in this paper to give an account of the pesticides that can be adopted in plant protection, their peculiarities and adverse effects, dosages and concentration, etc., for the benefit of agriculturists and horticulturists.

Older Insecticides: A certain amount of basic knowledge on the habits of insects is necessary for the judicious application of these pesticides. Calcium arsenate and lead arsenate come under the category of stomach poisons and are in use even at the present day against insects which, while remaining outside, bite and feed on different parts of the plants. These are applied as sprays at the rate of half an ounce of the chemical mixed with one ounce of air-slaked lime in a gallon of water. Calcium arsenate is also used as a dust after mixing one pound of the chemical with four pounds of lime. Generally soap and sulphur combinations are not compatible with the arsenates. The contact insecticides in vogue against aphids, jassids, thrips, etc., include crude oil emulsion and Fish oil rosin soap which are used at a concentration of one pound in six to eight gallons of water. The latter formulation is effective even against hairy caterpillars. Tobacco, which is also a contact insecticide, is used either as a water extract with the addition of some soft soap at the rate of half an ounce per gallon of the spray fluid or dust and is a specific against aphids and thrips.

Synthetic Insecticides: These chemicals (organic compounds), synthesised soon after World War II, come under two broad categories— Chlorinated hydrocarbons and Organophosphates. An interesting feature about these formulations is that they show a combination of contact as well as stomach action. To a certain extent a few of them also possess a fumigant action.

I. **Chlorinated Hydrocarbons:** (a) *DDT (Dichloro diphenyl trichloro ethane):* This chemical has a high residual action and is a specific against certain categories of insects viz., jassids and cutworms. DDT is comparatively slower in action and a distinct reduction in the pest population will be perceptible only in the course of 48 hours after treatment. This insecticide has only a feeble action against grasshoppers

and is ineffective inert against plant lice, coccids and mites. DDT has been found to stimulate plant growth in the case of brinjal, cruciferous vegetables, sugarcane, groundnut, tobacco and cotton.

There are also instances where an indiscriminate use of this chemical has brought in its wake a secondary infestation of mites, aphids and coccids. This phenomenon is due to the lethal action of the chemical against the parasites and predators of crop pests. A certain amount of foliage injury has also been noted on curcurbitaceous plants as a result of application of DDT. Particular care has to be taken in the treatment of fruit trees like limes, lemons, etc., where there is the risk of a greater absorption of the chemical by the oil present in the outer peel of the fruits.

The standard concentrations in use in plant protection (available under various trade names such as 'Guesarol', 'Didimic', 'Hexamar DDT' etc.) are the 5 and 10% dusts and 50% wettable powder. The dusts are applied as such while the spray fluid is prepared by mixing one ounce of 50% wettable powder in three gallons of water,

(b) *Technical BHC (Benzene hexachloride):* This chemical has got a quicker knockdown effect than DDT. To a certain extent it has a fumigant action also. The vapour pressure of BHC is considerably higher than that of DDT and as such the residual action of the former chemical is of a shorter duration. BHC has proved quite effective against a variety of crop pests which are external feeders. Repeated applications have also given a certain degree of relief against tissue borers. This chemical has a few advantages over DDT. The chronic toxicity of BHC is much less than that of DDT and even from the point of view of the persistence of insecticidal residues the former is safer as the highly toxic 'gamma isomer' is reported to disintegrate rapidly.

The injudicious use of this chemical has been noted to bring about a phytocidal action by way of leaf-scorching or stunted growth. The plants belonging to the family *Curcurbitaceae* are highly sensitive to this chemical and as such it would be safer to avoid its use in this case. Another serious disadvantage with technical BHC is that the taint of the chemical is imparted to the produce of the treated plants, especially fruits, vegetables and tuber crops. These adverse effects have been attributed to the *alpha* and *beta isomers* and the impurities present in technical BHC. As a soil insecticide at higher concentrations it affects the germination of seedlings.

As in the case of DDT, this chemical (available under trade names such as 'Gammexane', 'Benexide', 'Klortex', 'Hexamar BHC', 'Lethal rock BHC', etc.) is used as a dust at 5 and 10% concentrations. The dilution of the spray fluid in this instance is generally based on the gamma isomer contents, the strength of 50% wettable powder being 6·5% gamma. On this basis it has been worked out that 1¼ oz. of the chemical in one

gallon of water will give 0·05% (gamma) spray. Higher concentrations of the dusts and spray may be used against hardy insects.

(c) *Lindane:* This product is a purified preparation of technical BHC built up with pure gamma isomers. The insecticidal efficacy of this preparation is on a par with that of technical BHC. The advantage in this chemical is that it may be applied even against pests of fruits and vegetables without fear of ruining the palatability of the produce. The formulation can also be applied judiciously against cucurbits. Lindane is available as dusts and wettable powders, the standard ones in use being 0·64 and 1·3% dusts and 6·5% wettable powder. The dusts can be applied as such while the spray fluid is prepared on the lines indicated against technical BHC.

(d) *Toxaphene (Chlorinated camphene):* It has the quicker knockdown effect of BHC but shows residual action for a considerable time as in the case of DDT. It possesses a combination of the insecticidal action of both the chemicals and may, therefore, be used to act on behalf of the two pesticides. In the case of a combined infestation of aphids, jassids, thrips and caterpillars which is a common feature in cotton, this pesticide has given very convincing results. Toxaphene is highly toxic to cucurbits but does not interfere with the viability of the seed material when used as a soil insecticide. The chemical is available as dust at 10% and 20% and in wettable forms also. The spray fluid may be applied at 0·1% concentration (i. e. one ounce of cent per cent Toxaphene in 6¼ gallons of water).

(e) The other formulations coming under this category which are still in the experimental stage in this State are Chlordane, Aldrin, Dieldrin, Endrin and Isodrin. The first chemical is highly phytotoxic against cucurbits and there appears to be nothing spectacular even as regards its insecticidal efficacy. The other formulations have a high insecticidal action besides being free of phytotoxic hazards, even against cucurbits when applied as a spray.

II. **Organophosphates:** These formulations are highly posionous and have to be handled with the utmost care. An account of the more important pesticides coming under this category is furnished below. It is also a strange coincidence that these chemicals are effective against those groups of insects for which the Chlorinated hydrocarbons are not of much avail.

(a) *Hexa-ethyl-tetra-phosphate (HETP):* As a spray at 0·1% concentrations (i. e. one ounce in 6¼ gallons of water) this chemical is particularly effective against aphids and thrips. In the case of hardier types of insects like mealy bugs and coccids a higher concentration of 0·2% may be necessary. It rapidly hydrolyses to non-insecticidal compounds and can, therefore, be used without fear of toxic hazards even in the case of vegetables. It is compatible with lime and Bordeaux mixture.

(b) *Tetra ethyl pyrophosphate (TEPP):* This is the main active insecticidal principle in HETP also. TEPP has a longer residual action and research on the adaptability of this chemical is still in progressel Malathion is yet another product coming under this category which is stil· in the experimental stage.

(c) *Parathion (Diethy-nitrophenyl thiophosphate):* This is a formulation much more powerful than HETP and is designed to give a greater persistence on the treated plants. It is used at a concentration of 0·025% (i. e. one ounce of 20% Parathion in five gallons of water—available under trade names such as 'Ekatox-20', Folidol E. 605, etc.) and has a contact as well as fumigant action. The chemical is effective against hairy caterpillars and coccids. Encouraging results have been obtained even against the paddy stem borer — *Schoenobius incertellus W.* This chemical is not compatible with alkalies and Bordeaux mixture. The application of the chemical may be stopped a month prior to harvest.

Another interesting development in pest control is the synthesis of what are known as '*Systemic insecticides*'. When applied either to the soil or on the plants, these formulations are absorbed and translocated to the different parts of the plants along the cell sap rendering the latter toxic to certain groups of insects. Further they are retained by the plants for a considerable time (about four to five weeks under Indian conditions) and do not exhibit any lethal action on the natural enemies of these pests. These chemicals also come under the category of organophosphates (represented by Schradan, Sytam and Tetrax). A few other formulations represented by B.F.P.O. and Isopestox come under the category of Fluorohydrins. The investigations so far conducted have indicated their usefulness only against aphids, mites and a few species of mealy bugs when applied at a concentration of 0·075%.

Rodenticides: Zinc phosphide baits have given spectacular results against rodents. The bait is prepared by mixing one part of the poison with 49 parts of a suitable base like popped rice with the addition of a few bits of onions to render the bait more attractive. It would be advantageous to expose the unpoisoned food for a couple of days and follow it up with poisoned baits. As the chemical is highly poisonous to human beings and domestic animals, great care should be taken in its use. The latest rodenticide - Warfarin (Dethmor) has also given encouraging results against migrating rats and investigations on the baiting technique are in progress.

Acaricides: The incidence of mites is fairly common on horticultural and agricultural crops. Application of sulphur either as a dust or spray (at one pound of the wettable powder in 20 gallons of water — available under trade names, viz., "Sofril", "Thiovit", etc.) has been found to give considerable relief.

Conclusion: Before concluding the account on the developments in the insecticidal methods of pest control, it has to be mentioned that notwithstanding the synthesis of some of the more potent insecticides, the problem of the control of tissue borers still remains unsolved. There is a need for an effective insecticide which will get into the texture of the plants and cause the death of these internal feeders without in any way proving detrimental to the human beings or domestic animals consuming the produce of the treated plants.

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The Condition Factor for Paddy and the Irrigation Facilities available in certain Districts of Madras State during the last Fifty Years

by

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Introduction: The estimate of output of any crop for each district in a given year is the product of three factors, namely (1) the area under the crop in that year, (2) the normal yield per acre and (3) the condition factor for that year. The area under the crop is compiled every year by village officers based on the actual area sown to that crop in each holding. So far as the normal yield per acre for paddy is concerned, this was worked out by the Director of Agriculture, Madras in the year 1919 for each district. This figure is continued to be adopted since then and upto 1949 - '50. The condition factor (or the seasonal factor as it is also called) is the percentage of the normal yield estimated to be obtained each year. If the season is normal in any year, the normal yield can be expected and therefore the condition factor for that year is expressed as 100. Conditions of drought, floods, incidence of pests etc., affect the yields. The village officers furnish every year their estimates of what percentage of the normal yield is expected from their villages. Based on these estimates and the area under the crop in each village, the average condition factor is calculated for each district. According to the Season and Crop Report for Madras State for the year 1951 - '52, the total

normal area under paddy in the thirteen districts comprising the Madras (Residuary) State is 5,951,130 acres and the normal output of paddy is 3,604,140 tons. Six districts have been chosen for the present study and they differ widely in soils, paddy seasons and the available irrigation facilities. These districts account for 64·4 percent of the total normal area and 66·1 percent of the total normal output of paddy in the Madras State.

Soils and paddy seasons: In Table I, the main features of the districts from the point of view of soils and paddy-growing seasons are given:

TABLE I

Soils and Paddy-Growing Seasons in the Selected Districts

District selected	Nature of soils in which paddy is grown	Main sowing and harvest seasons for paddy
South Arcot	Black clay and black loam	In 65% of the paddy areas, sowings are done between September and November. Harvests come off in January to March.
North Arcot	Black loam and red loam	Under wells, sowing is done in July—August (15·7% of the paddy area). In 51·5% of the area sowings are done in September to November. These receive water from tanks. Harvests are done in the above areas in November—December and February to April respectively.
Tiru-chirapalli	Alluvial and regar	In 70·7% of the areas sowings come off in September to November. Harvests come off in January to March.
Tanjore	Alluvial and regar	Over 90% of the sowings come off in August to November. The harvests are done in January to March.
Tirunel-veli	Black loam	In lands which receive water from freshes in the river (20%) sowings are done in June—July and harvests in September—October. In lands commanded by tanks (63%) sowings are done in November to January and harvests in February to April.
Malabar	Red ferruginous	In 58% of the lands sowings are done during the south-west monsoon in May to July and harvested in September—October. Another 19% of the lands are sown in October and harvested in January—February.

It is seen that the paddy soils in Tanjore and Tiruchirapally are more nearly alike while those in other districts differ from one another. Sowings and harvest seasons are roughly alike in South Arcot, Tanjore and Tiruchirapalli. In the remaining districts these seasons differ.

TABLE II

Area Irrigated and the Acreage and Output of Paddy in Certain Districts

District and Year		Total Area Irrigated	Percentage of area irrigated to the Total area irrigated by				Normal Area under paddy 1951—52**	Normal output 1951—52**	Normal yield per Acre
			Government Canals	Tanks	Wells	Others			
South Arcot	1911—12	514,446	30·8	53·1	13·0	3·2	..	..	..
	1931—32	511,427	28·7	52·8	13·5	5·1	537,250	299,950	1,752
	1951—52	545,355	38·5	34·4	25·7	1·4	(9·0)	(8·3)	..
North Arcot	1911—12	412,959	7·7	69·1	14·5	8·7	..	..	..
	1931—32	408,657	7·1	64·9	23·3	4.6	390,960	243,570	1,832
	1951—52	367,349	5·9	42·4	51·1	0·5	(6·6)	(6·8)	..
Tiruchirapalli	1911—12	328,404	41·4	23·3	32·4	2·9	..	..	..
	1931—32	281,815	43·6	21·8	31·4	3·1	426,160	261,350	1,819
	1951—52	435,353	35·8	37·0	23·6	3·5	(7·2)	(7·3)	..
Tanjore	1911—12	999,795	84·1	14·0	1·6	0·2	..	..	..
	1931—32	953,631	88·0	10·7	1·1	0·2	1,338,560	872,190	1,711
	1951—52	1,213,293	95·1	4·1	0·8	0·2	(22·4)	(24·2)	..
Tirunelveli	1911—12	326,941	15·3	54·3	29·0	1·4	..	..	..
	1931—32	284,716	17·3	55·0	25·6	2·0	320,120	238,070	1,997
	1951—52	345,189	14·5	61·3	23·4	0·7	(5·4)	(6·6)	..
Malabar	..	..	..	..	..	..	823,250	466,000	1,400
							(13·8)	(12·9)	..

** Figures in brackets are the percentages of the total for Madras State.

Irrigation facilities: In table II a picture of the irrigation facilities available in the six districts is also given. The salient features are: (1) Malabar; The paddy areas of this district are exclusively rainfed. (2) Tanjore: In Tanjore a substantial portion of the irrigated area receives water supply through innumerable canals. In 1951–52, over 95% of the irrigated area received canal irrigation and this is 11% more than what it was 40 years ago. The area commanded by tanks is now only 4%. During the last 40 years an additional area of over 2 lakhs of acres has been brought under irrigation. (3) North Arcot: Only 6 to 7% of the irrigated areas receive canal irrigation. Wells which supplied water for 14% of the irrigated area 40 years ago now supply 51% but the ayacuts coming under tanks have decreased from 69% to 42%. The total area irrigated has been declining from 4·13 lakhs acres in 1911–12, to 4·09 lakhs in 1931–32 and to 3·67 lakhs in 1951–52. This seems to indicate that monsoon rains have been decreasing and underground water supplies are failing in that district. (4) South Arcot: Like North Arcot, South Arcot too, has recorded a decline in the ayacut under tanks. The increase in the area under well irrigation in South Arcot is also far less than North Arcot. Portions of South Arcot lying near the Cauvery delta command canal irrigation which accounted for 31% of the irrigated area in 1911–12 and 38% in 1951–52. The total area irrigated in South Arcot has increased by nearly 31,000 areas during the last 40 years. (5) Tiruchirapalli: More substantial is the increase in the area irrigated in this district. During the last 40 years an additional area of over a lakh of acres has received the benefits of irrigation. In 1951–52, 20,000 acres more have received canal irrigation as compared with the area irrigated by canals in 1911–12. The actual ayacut under tanks too has doubled itself in this district but the area receiving irrigation from wells has remained stationery during the last 40 years. (6) Tirunelveli: Over 60% of the irrigated area is commanded by tanks. Government canals supply water only to 15% of the irrigated area and wells to less than 25%.

Putting it briefly, the paddy lands of Malabar depend entirely on monsoon rains and those in Tanjore on canal irrigation. Water supply in North Arcot has been dwindling and about one half of the irrigated area of that district gets water from wells and the rest from tanks. South Arcot and Tiruchirapalli are now almost alike and 1/4th of the irrigated areas of these districts are commanded by wells and one-half of the balance is under the ayacuts of tanks and the other half receives canal irrigation. In Tirunelveli more than half the irrigated area is under the ayacuts of tanks and the balance gets irrigation from wells and from Government canals. The six districts selected for the present study therefore present a wide variety of conditions in soils, in seasons and in irrigation facilities.

Normal acre yields: Since the condition factor is a percentage of the normal yield per acre expected to be actually obtained in any year, it is necessary to take into account the normal yields adopted during the last

50 years covered by the present study. If the normal yields are pitched high, the condition factor will be low since the actual yield will be a smaller percentage than what it will be when a lower figure for normal yield is adopted. The normal yield of paddy as given in the Season and Crop Reports of Madras State of the respective years are given in table III.

TABLE III. Normal yields of paddy. *(In pounds per acre).*

District	1902–03 to 1904–05	1905–06 to 1909–10	1910–11	1911–12 to 1917–18	1918–13 to 1949–50	1950–51 onwards
South Arcot	..	1350	1700	1700	1850	1752
North Arcot	..	1650	1650	1800	1900	1832*
Tiruchirapalli	..	1450	1800	1800	1900	1819
Tanjore	..	1600	1600	1600	1750	1711
Tirunelveli	..	1350	1800	2000	2000	1997
Malabar	..	1350	1400	1400	1400	1400

* In the Season and Crop report for 1950–51 this is given as 1332 whereas in 1951–52 it is given as 1832.

TABLE IV. Frequency Distribution of the "Condition Factor" for Paddy in Certain Districts

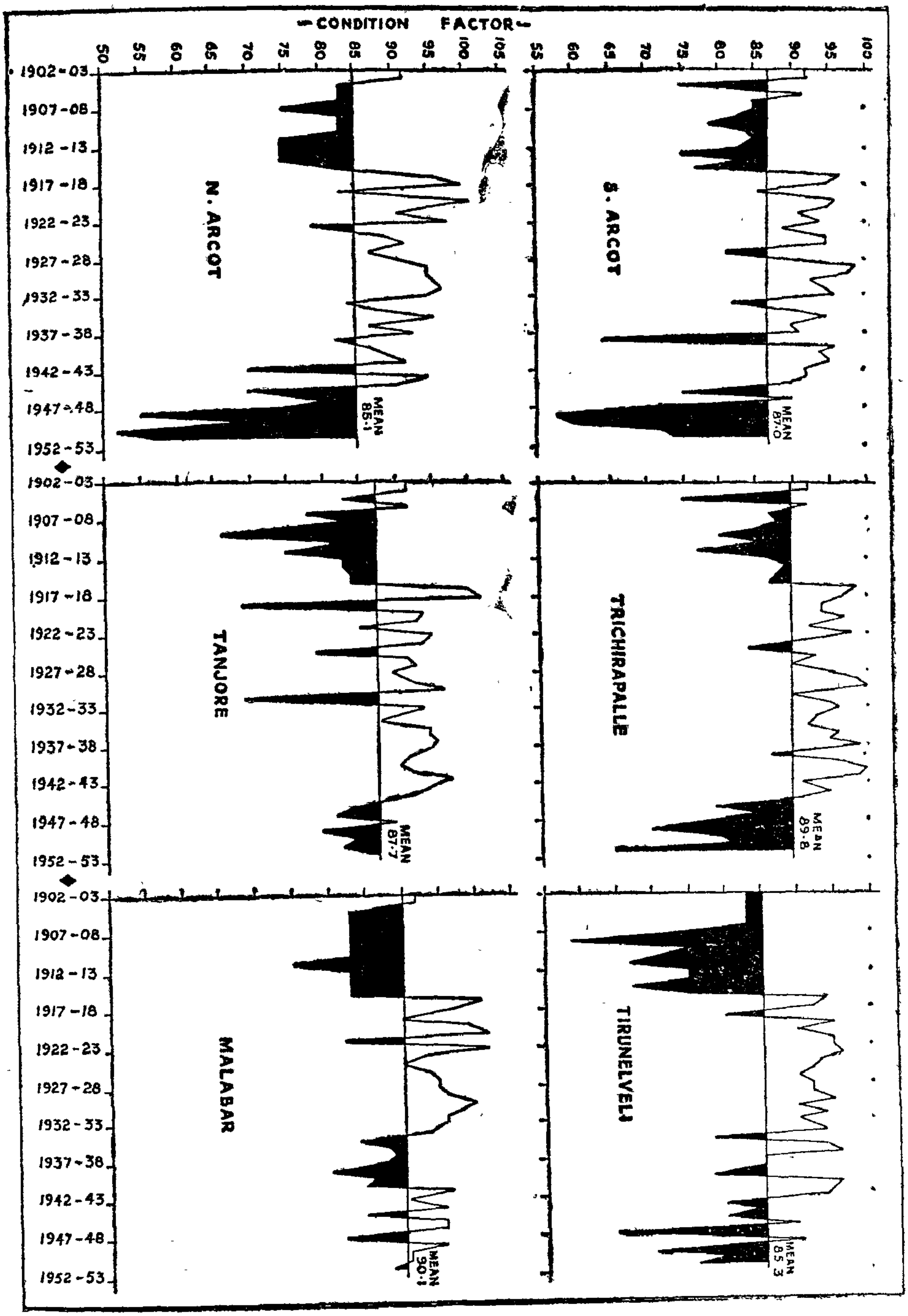
District	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	100–104	Total	Mean	Standard deviation	Coefficient variation
South Arcot ..	—	1	2	—	3	5	6	5	15	13	—	50	87·0	11·4	13·1
North Arcot ..	1	2	—	—	3	7	11	6	8	10	2	50	85·1	10·8	12·7
Tiruchirapalli ..	—	—	—	—	2	4	4	10	15	14	1	50	89·8	7·7	8·6
Tanjore ..	—	—	—	3	—	4	11	6	16	8	2	50	87·7	8·5	9·7
Tirunelveli ..	—	1	—	3	2	8	9	3	16	8	—	50	85·3	8·8	10·4
Malabar ..	—	—	—	—	—	1	15	7	10	13	4	50	90·1	6·8	7·5
	1	4	2	6	10	29	56	37	80	66	9	300	87·2	10·8	12·4

Condition Factor: In table IV the frequency distribution of the condition factor during the last 50 years for the six selected districts is given. It will be seen from it that the distribution is not strictly normal.

The number of years having a condition factor of 70 and above increases gradually till the 'mode' is reached. The frequency then decreases steeply. The normal yield or anything above it (i. e. the condition factor of 100 and above) has not been met with in any year during the last 50 years in the districts of South Arcot and Tirunelveli. North Arcot and Tanjore each experienced this situaiion in only two out of the 50 years and Tiruchirapalli only in one year. Malabar has been fortunate in having had four years out of the fifty in which the condition factor was 100 and above. This district has not also experienced any year in which less than 75 percent of normal yields were obtained. Tiruchirapalli has not seen a condition factor less than 70 percent and Tanjore less than 65 percent. South Arcot, North Arcot and Tirunelveli have seen very bad seasons in which only 50 to 60 percent of the normal yields were obtained. The mean condition factor for all these districts is between 85 and 90 and the difference in the means for individual districts is not statistically significant. The Coefficient of variation for seasons is the least, namely 7·5 percent in Malabar showing that the conditions in this district are generally uniform. It is highest (13·1%) in South Arcot. For all the six districts together the mean condition factor is only 87·2. The trends of the condition factor for each district are represented in the graph attached. The existence of successive years of bad and good condition factors is revealed in these graphs and they can be grouped as shown below:

(1) About twelve successive years from 1904—'05 to 1915—'16 in which the condition factor was below the mean in all the six districts. (2) About thirty years of above-the-average condition factors from about 1916—'17 to 1945—'46 in all districts except Malabar. (3) Adverse condition factors in all districts except Malabar from 1945—'46 onwards. Till 1951—'52 there was practically no recovery. (4) In Malabar the favourable period was from 1916—'17 to 1933—'34 only i. e. for 18 years. This was followed by seven unfavourable years. This district had again a favourable period from 1941—'42 to 1951—'52 except in three years.

Seasonal conditions do not really seem to have been adverse over successive years during 1904—'05 to 1915—'16. It is therefore difficult to explain why poor condition factors have been recorded in successive years in all the districts upto 1915—'16. Since firm normal yields based on a number of factors such as actual yield at Research Stations, actual crop sampling experiments etc. have been worked out in 1919 and adopted since then it is desirable to ignore the figures prior to 1918—'19. An era of prosperity seems to have dawned from about 1915—'16 and has generally been sustained upto 1944—'45. During this period all districts except Malabar had generally experienced more-than-average seasonal factors. The reasons for adverse conditions in certain years were as below: (1) Submersion of low-lying areas in the Coastal districts such as Tanjore. (2) Inadequate rains in Malabar. (3) Late or inadequate rains in districts which depend on freshes in rivers or in areas commanded by tanks and wells. (4) Excesive rains when crop is advanced in growth.


CONDITION FACTOR
N. ARCOT
S. ARCOT
TANJORE
TRICHIRAPALLE
MALABAR
TIRUNELVELI
MEAN 85·1
MEAN 87.0
MEAN 87·7
MEAN 89·8
MEAN 90·1
MEAN 85 3
1902-03
1907-08
1912-13
1917-18
1922-23
1927-28
1932-33
1937-38
1942-43
1947-48
1952-53

From the graphs it will be seen that during the 'twenties' and the 'thirties', Tirunelveli district has shown no depression in the condition factor. Malabar follows an independent trend. Acute adverse conditions have been experienced in North Arcot from 1945—'46 onwards. This is a district which depends on tanks and wells the water supply in which depend entirely on the receipt in adequate quantities of monsoon rains. It has therefore suffered most, consequent on the continued inadequacy of rains. In the prosperous period of the twenties and thirties the graphs for South Arcot and North Arcot are alike. So also the graphs for Tanjore and Tiruchirapalli. But during the adverse period of the 'forties the graphs for South Arcot and Tiruchirapalli which have similar irrigation facilities now are alike.

TABLE V

Results of crop sampling survey in certain districts of the Madras State

Name of District	Year	Output of paddy in thousands of tons			Remarks
		As per Crop Sampling Survey	As per official estimate	Difference expressed as %age of col. 3	
(1)	(2)	(3)	(4)	(5)	(6)
1. South Arcot	1949—50	350·8	245·9	—30	
	1950—51	311·9	253·0	—19	
	1951—52	346·2	273·8	—21	
	Average	336·3	257·6	—23	
2. North Arcot	1949—50	270·2	242·9	—10	
	1950—51	247·7	127·5	—49	
	1951—52	156·7	155·2	— 1	
	Average	224·9	175·2	—22	
3. Tiruchirapalli	1949—50	307·5	305·6	— 1	
	1950—51	350 8	288·2	—18	
	1951—52	271·6	266·2	— 2	
	Average	309·9	286·7	— 7	
4. Tanjore	1949—50	732·8	880·1	+20	
	1950—51	787·9	910·0	+15	
	1951—52	879·0	916·5	+ 4	
	Average	799·9	902·2	+13	
5. Tirunelveli	1949—50	188·0	182·1	— 3	
	1950—51	250·7	222·9	— 8	
	1951—52	222·4	251·1	+13	
	Average	220·4	221·0	—	
6. Malabar	1949—50	373·1	470·0	+26	
	1950—51	397·0	476·6	+20	
	1951—52	403·0	471·7	+17	
	Average	391·0	472·8	+21	

Note:— (1) The figures in Col. 3 have been worked out from the figures of output of rice given in the "Administration Report of the Agricultural Department" for the respective years.

(2) The figures in Col. 4 are from the Season and Crop Report of the respective years.

Discussion and conclusions: This study reveals that anything like the normal yield of paddy has not been obtained over a substantial period during the last half a century, the mean condition factor having been between 85 and 90% in the six districts under study. This shows that the normal acre yields have been pitched too high. In Table V are furnished the estimates of total output of paddy during the last three years in the six districts based on crop sampling surveys and on the condition factors. It will be seen that the official estimates of output in Tanjore and Malabar based on the condition factors have been on the high side during all the three years. In the remaining districts it has been consistently on the low side except in Tirunelveli during 1951 - '52. The average of the three years shows that the output has been over-estimated by 13% and 21% in Tanjore and Malabar respectively and under-estimated by 7% in Tiruchirapalli, 23% in South Arcot and 22% in North Arcot. The average variation for the three years for Tirunelveli is 'Nil'. This seems to indicate that besides pitching the normal yield too high the estimates of condition factors too were put on the high side in the districts of Tanjore and Malabar. In other districts which have a less assured water supply the official estimates of output were more cautious indicating that the estimate of condition factor for each district should be as near as possible. This has not been realised during the last fifty years. This can be achieved only by revising the figures of normal yield to levels which can really be possible of attainment over many years and not something which can be reached in just less than 5 years out of fifty. The fixation of a more realistic figure for normal yields perhaps based on the crop-sampling surveys now in progress seems warranted.

This study has once again brought out the well-known fact that seasonal vagaries can more nearly be overcome in areas which enjoy the benefits of assured seasonal rains and those which enjoy supply of irrigation water from river systems. In a district like Tirunelveli where a substantial portion of the paddy crop matures in the warmer months of February to April the acre yields are the highest.

REVIEWS

Annual Report of the Research division, Sudan Government, Ministry of Agriculture, 1950—'51; Pp. 787; one map; McCorquodale & Co. (Sudan) Ltd.; 1953:

The main work was on cotton. Other crops handled are Sorghum, Eleusine, Pulses: Vigna, Pigeon pea, Cicer, Pasture grasses, Rice, Grounduut, Sesamum, Sun-flower etc.

Cotton research in Sudan (1950-51): The activities of the Research Division of the Ministry of Agriculture, Sudan Government during 1950–51 marked the usual progress in cotton research carried out by the different sections in the Gezira Research Farm and at the Shambat station. Several agronomic experiments of a long term nature were in progress in the Gezira Research Farm and the season's results of individual experiments were mostly as per expected indications. Cotton-Lubia *(Dolichoas lab-lab)*—Fallow was the best three course rotation, while Cotton-Lubia was the best two course rotation. There was no significant difference between dates of application or between average responses to different types of nitrogenous fertilizers. There were no significant responses to phosphate or potash in 1950–51. The level of all yields was high and responses to nitrogen large. The residual effect of ammonium sulphate applied in 1947 was well marked in the case of heavy applications like 160 and 240 rotls N/feddan. In a variety–spacing–date of sowing and manuring experiment, analysis of the yields showed that for Sakal and x 1730A, sowing dates in August were significantly better than in September, but for the American Cotton SP. 84, the end of August and September were better than mid-August. Sakal and x 1730 A yielded better than SP. 84. Very close spacing (20 c. m. between plants) significantly reduced yields and nitrogen gave a marked increase.

Considerable plant observation data have been gathered since 1940 from the Gezira observation plots and a tentative analysis of part of the data has been completed.

Work on the nutrition of the cotton plant showed that (1) reducing sugars were higher in the mature seeds of immature bolls, (2) sugars were present in bad lints but not in good lints, (3) and that a positive tannin test was correlated with low nitrogen content in the leaf. Pot experiments with Gezira soil indicated that the effect of phosphate was limited by the nitrogen supply. Limited data from investigations on optimum size of plots suggested, that if the total area of a trial was fixed, the greatest-precision would be obtained by reducing plot size to a minimum and so increasing the number of replication. No significant differences were found in experiments on pretreatment of seed with fertiliser solutions.

The main breeding policy was the production of strains of Sakel and 1730 which would be equal to the existing commercial strains in yield and quality, but be resistant to leaf curl, *blackarm* and *jassids*. The breeding work may be regarded as practically complete as regards *blackarm.* but the introduction of factors for leaf curl and *jassid* resistance was in progress. Blackarm resistant 1730 (BAR XL–1) was grown for the first time on a commercial scale and the yields were fair and grade excellent.

At Shambat, this season had virtually completed the work on *blackarm* resistance and the addition of leaf curl resistance was in progress. A wave of BLR 14/25, almost immune to *blackarm* and moderately resistant to leaf curl was released and further filtering of BLR 14/25 towards increasing its leaf curl resistance was in progress.

In the hybridisation between tetraploid *herbaceum* and Sakel, the *herbaceum blacaarm* resistance gene was successfully carried to the fifth Sakel backcross. B_5, the resistances gene from Grenadines White Pollen and B_7, the resistance gene from Stoneville 20 were successfully carried to sixth and fourth Sakel backcross respectively.

The production of *blackarm* resistance strains of American Upland also engaged attention and the addition of B_3 to Uganda BP-52 strain, already homozygous for B_2 was in progress.

In the *jassid* resistance programme, a blackarm (B_2) resistant and leaf curl resistant Sakel, homozygous for H_1 was synthesised for use as a backcross parent in the hairiness transference.

In the transference of lint strength from *G. thurberi* to Sakel, a number of F_8 lines of *G.* '*thurbadense*', x Domains Sakel were sown and plants with Pressley strength indices upto 10·2 were selected as against 7·7 for the controls.

In the transference of an increased number of locules from *sanguineum*, *herbaceum* and Phillippines Ferguson to Sakel, plants with mean locule number of 3·63 to 3·77 were isolated in different backcross generations.

The section of Entomology carried out studies on the ecology of the cotton jassid (*Empoasca libyca*, de Berg) and found that by eradicating vegetable and weed host plants, the *jassid* populations in gardens could be reduced to unimportant numbers. Experiments on the effectiveness of newer insecticides and spraying by fixed wing aircraft against cotton *jassids* were in progress. (V. S.) [Ed. 1 Feddan = 1·038 acres; 1 Rotal = 0·99 lbs.]

AGRICULTURAL NEWS LETTER, MADRAS

Perennial Fodders and Grass Farming — Introduction: With the ever-increasing population of the country, the strain on the cultivated area is so great that people are tempted to encroach upon forest areas, meadows and pasture lands. This indirectly affects the poor cattle and in particular the milk cows. It is a common experience that cows in milk require green feed to maintain the production of milk and normal health. Since, the main source of green feed viz. Forest areas, meadows and pasture lands are inadvertently encroached upon for cultivation, the requirements of animals have dwindled. This engaged the attention of the scientists and the problem was successfully tackled by isolating a few varieties of perennial grasses. The intensive cultivation of these perennial grasses by suitable manuring and systematic irrigation is really a boon to the ryots.

Details of cultivation of perennial fodders — Soil: Loamy soil with better irrigation facilities and drainage is suited for the cultivation of irrigated grasses.

Preparatory Cultivation: The land is given four ploughings two with iron ploughs and the rest with the country plough so that a proper tilth is obtained. The breaking of clods with mallets may be resorted to, if necessary.

Manures and Manuring: Where there is no facility for sullage or sewage irrigation, well-decomposed cattle manure is applied at the rate of 25 tons per acre, the manure being covered with the country plough. The application of 25 to 50 lb. ammonium sulphate by dissolving it in irrigation water can be resorted to when very rapid growth is desired.

Seeds and Sowing: The soil is then thrown into ridges and furrows made 2½ feet apart with the help of a ridge plough or with human labour. The propagation of perennial grass by seed is found very difficult and wasteful. The best and the easiest method of propagation is by slips. In the case of perennial grasses a portion of the stem with a few roots is known as the slip. Mostly they are tillers produced by the previously planted material. About 20,000 slips will be required for planting an acre. Two slips are planted per hole (to avoid gaps) on the sides of the ridges one foot apart.

Irrigation: Water is let into the channel and the slips are then planted. Life irrigation is given on the third day. The third and the fourth irrigations are given at an interval of 4 days each from the date of the life irrigation. Subsequent irrigations are given once a week.

When permanent grass is to be maintained purely on sullage or sewage irrigation, careful planning is required. Generally sullage water will be available daily and the area to be grown with grasses will have to be determined on the basis of minimum avilability of sullage water per day. Since irrigation is normally given once a week, the area that can be commanded by seven days' supply can be easily be determined. Sullage or sewage irrigation results in sedimentation of organic matter on the land giving rise to sullage sickness. To over come this condition, the sedimentation will have to be scraped out and removed periodically.

After-Cultivation: When the plots get weedy, country plough can be worked in between the rows. Human labour is employed to earth up as well as to remove weeds along the row.

Harvest: The best time for the harvest of grass is just before flowering. If it is too early, the outturn will be affected and if late, the quality of grass deteriorates. The interval between harvest varies with the variety of grasses. The optimum interval for individual grass can be determined by experience. The yield of grass improves from the first cutting and remains at the same level for a period of six months. Depending upon the daily requirement of green fodder, the plot may be divided into strips and the grass cut at suitable intervals, so that the daily supply may be maintained.

Quartering: When perennial grasses remain in the field for a number of years, the clumps become bigger in size due to tillering and the number of dead shoots increases resulting in poor outturns. The crop becomes old and requires rejuvenation. Under such circumstances the grass clumps may be cut into four parts and three parts may be removed leaving the fourth part to develop. In quartering it should be noted that dead shoots are discarded as far as possible.

Comparative trial of fodder grasses conducted on the Central Farm, Coimbatore: Guinea grass and Napier grass were introduced on the Central Farm Coimbatore in the year 1920 and these grasses were raised under sullage irrigation, supplemented with well water mainly for keeping the Dairy herd on green fodder. Water grass was introduced in the year 1947 and the Cumbu X Napier grass was also evolved recently. With a view to study the comparative yields of these grasses an experiment was laid out with all the four grasses under sullage irrigation in the year 1950 which concluded in the year 1953. From the analysis of

the data, it was found that Napier grass gave the maximum yield by giving an average yield of 2,60,000 lb. per acre per year. The next was the Cumbu X Napier grass with an average acre yield of 1,90,000 lb. per acre per year. The details of the experiment are furnished below.

Field No. 70 (Eastern block)

Size of plot: 30 links × 25 links — 0·75 cent.

Date of planting: 23—5—1950.

Lay out: Randomised block.
Application: Six replications.
Treatments: Five.
(A) Napier grass.
(B) Guinea grass.
(C) Cumbu X Napier grass.
(D) Water Grass.
(E) Kolukkattai grass.

Date of harvest: 6—9—1950; 26—10—1950; 17—12—1950; 5—2—1951; 29—3—1951; 19—3—1951; 9—7—1951; 29—8—1951; 24—10—1951; 14—12—1951; 8—2—1952; 29—3—1952; 19—5—1952; 10—7—1952; 31—8—1952.

* The grasses were irrigated with sullage water.

Utility: The introduction of perennial grasses is closely linked up with dairy farming. But in our State the average number of cows and the average holding of irrigable lands possessed by each farmer is so slow that the spread of these grasses has not been appreciable. But however since the "Drink More Milk" campaign has come to stay and the Government and local bodies are anxious to tackle the problem of milk production and supply on a co-operative basis there is immense scope for the spread of these perennial grasses in future.

Sewage cum Dairy Farms: In corporations and big municipalities, the disposal of sewage is a problem and it is often a menace to the health of the population. But this can be utilised to the best advantage by diverting them for raising perennial grasses. This not only reduces the cost of irrigation but at the same time encourages the growth of perennial grasses. The corporations and municipalities that can afford to maintain a dairy, can combine both these aspects, and restrict the numbers of animals to the availability of green fodder and this would go a long way in solving the milk problem.

Maintenance of grass farms by municipalities: In municipalities who cannot afford to maintain a dairy, grass farms can be opened by utilising the sullage or sewage water as the case may be and sell away the produce out right to the consumers at a fixed rate and thus help in augmenting the milk supply in the municipal areas.

Grass Farming on Co-operative basis: The Co-operative milk supply unions formed in many municipalities can take the responsibility of supplying green fodder to its members. They may arrange to run grass farms either with the help of the municipalities or with their own efforts and supply their members with green fodder at a fixed price.

Individual Enterprise: In the Central Farm, Coimbatore, Napier grass and Cumbu X Napier grass have recorded acre yield of 2,60,000 lb. and 1,90,000 lb. respectively. Leaving a liberal margin of 50% for sullage irrigation a ryot can easily get 1,30,000 lb. of Napier grass and 95,000 lb. of Cumbu X Napier grass per acre. The value of these at the rate Re. 1/- per 100 lb. works out to Rs. 1,300/- and Rs. 950/- per acre. Taking the cost of cultivation at Rs. 500/- per acre the ryot can get a net income of Rs. 800/- and Rs. 450/- per acre for Napier grass and Cumbu X Napier grass. When once cultivated, these grasses can be maintained for years, by proper irrigation, manuring and quartering whenever necessary. Thus a ryot can grow permanent grasses and sell them to the consumers and make a decent profit.

Conclusions: There is every change of the "Drink Milk", campaign being intensified as no equally good "protective food" is available. The perennial grasses will play the most important part in the production of milk. Though individual efforts cannot be completely ruled out, co-operative effort through Government and Local bodies will go a long way in popularising these permanent grasses and thus help to increase the production and supply of milk to the millions who are now so very inadequately fed with this item of food, which is essential for the maintenance of health both in adults and infants. (Director of Agriculture, Madras.)

EXTRACTS AND GLEANINGS

Colchicine Treatment of young seedlings as a means of inducing polyploidy by H. Douwes — Gent: 51. 1952. 7-25. (Ministry of Agriculture, Sudan Government. Mem. Res. Dis. No. 28, 1952.)

Many different techniques of applying colchicine to dividing tissue are in use. The author of the paper deals with the treatment of germinating cotton seed from which the seed coat has been removed before the application of colchicine. In the *Gossypium* removal of seed coat is important as great differences occur in the hardness of seed coat. The wild species have typically hard seed coats and chipping of seed coats is necessary to achieve quick and regular germination. Although the seed of cultivated species normally germinate without chipping, certain strains like 'Demak' belonging to G. *arboreum* race *burmanicum*, from Java, showed irregularities in germination when the seed coats were not chipped. In order to eliminate the variability caused by the hardness of seed coat which affected the speed of penetration of colchicine solution, the removal of seed coat is essential. A correct estimate of the time limit of application and of concentration of solution may then be possible for recommending to *Gossypiums*, as a whole. In case of the cultivated cottons, removal of seed coat with the thumb nail can eassily be achieved after the seeds have been soaked between wet blotting paper for about 24 hours.

The author has reviewed his previous work conducted on cotton with colchicine by Mendes, Harland and others. He distinguishes the growth-stunting effect caused by colchicine treatment as a result of toxic effect from the slow growth rate normally found in tetraploid tissues. While in the latter the growth rate is constant, in the former stunting is proportional to the concentration of the colchicine solution present in the growing tissue. The toxicity affects all seedlings eqaully, whether they have become polyploid or not. This toxic effect diminishes gradually with the last traces of colchicine from the tissue. In measuring the rate of growth shortly after treatment those two causes of delay have not been separated. As the polyploidizing effect of colchicine is bound in time with the rate of cell division, too short an exposure will not have the desired effect. Because of its toxicity, a high temperature during the treatment might therefore

be unfavourable, as death will be caused within a shorter time of exposure. Under tropical conditions with temperatures rising to 45°C. or higher this needs to be considered. The polyploidizing effect of colchicine was judged on the basis of chromosome counts in pollen mother cells and on measurements of stomatal length. Young cotton seedlings were treated in two different ways with colchicine as a means of inducing polyplody. In the first method the seeds were soaked in water for 24 hours and the seed coat was removed and the whole bare embryo directly exposed to colchicine between blotting paper soaked in solution. Two concentrations were used viz., 0·025% and 0·050% in distilled water. At a a temperature of 21—26°C, a 12-hour exposure to 0·025% (12 × 0·025 = doze 0·30) proved to be sub-lethal as also an 8-hour exposure to 0·025% (doze 0·10) or one hour in 0·050% (doze 0·050) on the other side. A great handicap of the technique is the severe secondary toxic effect of the colchicine, especially on the root system, causing a marked check in growth.

In the second technique the seed coat was also removed after about 24 hours soaking in water but the treatment was postponed for 4 days after the commencement of the germination. The advantage of this method is that the root grows longer, enough (i. e. 1 cm. or more) to permit the treatment of the shoot only, by inverting the young seedling with its growing points in a small tube of colchicine solution. This greatly reduced the check in growth. Only 0·050% colchicine was used in this technique and the heaviest treatment given was 10 hours (doze 0·50) at a temperature between 23 and 26°C. By using this method tetraploidy was induced by 2-hour treatment (doze 0·10) upwards. The optimal dosage is likely to be near 0·30 i. e. a six-hour treatment.

It is concluded, that the second technique, where the roots are kept outside the colchicine solution, is to be recommended. With this technique at a temperature between 23 and 26°C. tetraploidy occurred following 2-hour treatment in 0·050% (doze 0·10) upwards. It is not advisable to use weaker concentration 0·025% since the results obtained in the experiments indicated that a treatment of 12 hours or more in 0·025% is more toxic than the same dosage obtained with half the time at double the concentration, while no advantage in efficiency of polyploidizing is obtained. (N. K. I.)

Striga Control: In the Sudan it was found that sorghum yields grain and fodder had gone very low in lands put under continuous cultivation. This low yield was attributed to the poverty of the soils and so the land especially in the tropics must be given periodical rest. In a few such lands put to sorghum and traditionally low yielding it was found that significantly larger yields were obtained by control of *Striga hermontheca* with the help of hormone weed killers. It is not clear whether the poor yields were due to running out of the soil or due to over-parasitisation. (K. Wilson, Sudan. Dept. Agri. and Forest Res. Nature **172**; 128; 1953) (N. K. S.)

CROP AND TRADE REPORTS

Crop Statistics, Madras State, 1953—'54. Tobacco—First forecast: The area sown with tobacco upto 25th December 1953 is estimated at 40,100 acres and shows an increase of 2·0% over the corresponding period of last year due mainly to better seasonal conditions. An increase in area is estimated in the districts of South Arcot, North Arcot, Coimbatore, Tanjore and South Kanara same as last year and a decrease in Madurai, Salem, Tiruchirapalli, Ramanathapuram

and Tirunelveli districts and negligible in the districts of Chingleput, Malabar and the Nilgiris. The crop is reported to be generally satisfactory in all the districts of the State. The yield per acre is expected to be normal in all the districts of the State, except in North Arcot and Madurai where it is too early to report on the yield of the crop. The wholesale price of tobacco per maund of 82–2/7 lb. or 3,200 tolas as reported from important market centres on 9th January 1954 was Rs. 55—6—0 in Tiruppur and Rs. 39—6—0 in Erode and reveal a decrease of 19·1% in Erode and an increase of 7·7% in Tiruppur over last year.

Groundnut—Irrigated—First Report : The area sown with summer-irrigated groundnut crop during the three months January to March 1954 is estimated at 42,700 acres and shows an increase of 14·2% over last year. Compared with the average area of 40,800 acres calculated for the previous five years ending with 1953—1954, it is an increase of 4·7 per cent. The increase in area this year is due mainly to favourable seasonal condition. Sowings of summer irrigated groundnut are in progress in the districts of Chingleput and Ramanathapuram. The condition of the crop is satisfactory. The wholesale price of groundnut (machine-shelled) per standard maund of 82–2/7 lb. of 3,200 tolas as reported from important market centres on 3rd April 1954 compared with the prices published in the corresponding period of last year i, e. on 4th April 1953, reveal a decrease of 16·9 percent in Coimbatore, 15·5 percent in Cuddalore and 14·1 percent in Salem. (Director of Statistics, Madras.

Weather Review — For the month of April, 1954.

RAINFALL DATA (IN INCHES)

Division	Station	Total for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·1	— 0 5	2·9
	Tirurkuppam*	0·0	— 1·2	3·1
	Vellore	0·5	— 0·5	3·0
	Gudiyatham*	0·0	— 1·0	3 4
East Coast	Palur*	0·5	— 0·3	7·3
	Tindivanam*	0·6	— 0·4	8·1
	Cuddalore	1·1	+ 0·1	14·2
	Nagapattinam	1·6	+ 0·5	6·5
	Aduturai*	1 8	+ 0·9	7·0
	Pattukottai*	5·6	+ 3 8	11·8
Central	Salem	1·8	— 0·1	3·1
	Coimbatore (A. M. O.)*	2·5	— 0·6	6·8
	Coimbatore	3·6	+ 2·0	10·5
	Tiruchirapalli	3·0	+ 0·6	5·9

Division	Station	Total for the month	Departure from normal	Total since 1st January
South	Madurai	2·0	— 0·2	6·8
	Pamban	6·9	+ 5·1	10·4
	Koilpatti*	2·7	— 0·8	10·7
	Palayamcottai	1·2	— 1·3	9·4
	Ambasamudram*	1 1	— 2·8	18·2
West Coast	Trivandrum	7·1	+ 2·5	16·4
	Fort Cochin	8·6	+ 3·7	13·7
	Kozhikode	6·5	+ 1·6	7·7
	Pattambi*	4·9	+ 2·2	7·5
	Taliparamba*	3·1	..	4·6
	Wynaad*	..	..	..
	Nileshwar*	8·8	+ 6·8	10·3
	Pilicode*	8·1	+ 5 6	9·7
	Mangalore	4·2	+ 2·3	4 7
	Kankanady*	4·0	+ 2·4	5·1
Hills	Kodaikanal	5·9	+ 1·1	18·2
	Coonoor*	3·3	— 2·6	23·1
	Ootacamund*	3·7	— 0 4	7·9
	Nanjanad*	2·7	— 2·3	6·5

Note :—1. * Meteorological Stations of the Madras Agric. Dept.

A feeble low pressure wave was moving over the Comorin area on 3-4-1954. This passed away westwards across the Maldives area on 5-4-1954. A shallow low pressure area lay over the Punjab (I) and the adjoining areas on 17-4-1954, which passed away eastwards on the following day. A feeble low pressure area lay off the Konkan coast on 22-4-1954. This concentrated to a depression after two days, with its centre 200 miles south-west of Marmagao, moved in a north-northeasterly direction, weakened to a trough of low pressure on the evening of 25-4-1954 and got filled up on the very next day. A low pressure wave was approaching Tamil Nad on 27-4-1954. This was active over the extreme south Peninsula for a day and weakened. On the last day of the month a low pressure wave was moving westwards across the Andaman Sea into the south-east Bay of Bengal. A series of seven western disturbances passed over the extreme north of the country during this month. Thundershowers were fairly widespread along the West Coast and occurred at a number of places in Tamil Nad during this month. The noteworthy rainfalls and the Zonal rainfall for the month are furnished hereunder:

Date	Name of Place	Rain-fall	Name of Zone	Av. rain-fall for April	Dep. from normal	Remarks
13/4/54	Fort Cochin	2·4″	North	0·15	— 0·80	Below normal
23/4/54	Palghat	3·6″	East Coast	1·87	+ 0·77	Above normal
,,	Pattukottai	4·33″	Central	2·73	+ 0·48	Just above normal
24/4/54	Coimbatore	2·2″	South	2 78	+ 0·00	Normal
,,	Nileshwar	6 57″	West Coast	6·14	+ 3·01	Far above normal
,,	Pilicode	6·65″	Hills	3·90	— 1·05	Below normal
28/4/54	Pamban	3·2″				
29/4/54	Pattambi	3·17″				

Agricultural Meteorology Section
Lawley Road P. O.,
Coimbatore, 11—5—1954

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Transfers

Balasubramaniam, C. S, Asst. in Ento. Coimbatore, Crop and Plant Protection Officer, Coimbatore; Balasubramanian, T. N., D. A. O., Madurai, Spl. D. A. O., Mayuram; Daniel, F. L., Gazetted Asst. Lec. in Chemistry, Coimbatore, Asst. Agrl. Chemist, Coimbatore; Francis, T. S., Senior D. A. O. (Crop Sampling) Madras, Regional Dy. Director, Madurai; Govindaswami, C. V., Asst. in Myco. Coimbatore, Asst. Mycologist, Ootty; Krishnan, L., S. D. A., Tiruchirapally, D. A. O., Kumbakonam; Mohamad Ali, A., Regional Dy. Director, Madurai, Regional Dy. Director, Tanjore; Mariakulandai, Dr. A. Asst. in Chemistry, Coimbatore, Gazetted Asst. Lec. in Chemistry, Coimbatore; Syed Mohamad, P. P. Spl. D. A. O., (Crop Sampling) Shoranur, Spl. D. A. O. (Crop Sampling) Madras; Thangavelu, T. K., Marketing Asst. Madras, Gazetted Asst. D. A's Office, Madras; Varadachari, K, Regional D. D. Tanjore, Regional Dy. D. Vellore; Varghese, E. J., Asst. Agrl. Chemist, Coimbatore, Gazetted Asst. Lec. in Chemistry, Coimbatore; Vaidyanathan, M., P. A. to D. A. O. Tanjore, Spl. D. A. O. (Crop Sampling) Tanjore; Venkatasubramaniam, P. S., Spl. D. A. O. (Crop Sampling) D. A. O. Madurai.

Upper Subordinates

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